

ocean meteorology be transferred to the hydrographical department of the Admiralty; that the present system of collecting daily information by telegraph and of issuing storm-warnings be continued, an endeavour being made to put into clear shape, for the information of the public, the maxims or principles upon which storm-warnings in future are to be given; that the issuing of daily weather-charts be continued; that a certain number of continuously self-recording stations be retained; that the present system of supplementing self-recording observations by returns from eye-observers, that is, from ordinary meteorological stations, be continued; and, since the science of meteorology at present stands in need of hypothesis and discussion at least as much as, if not more than, of observation, that a part of the annual grant be appropriated to special researches, it resting with the Meteorological Council to select the investigators and fix the remuneration. Several of the recommendations are not put in the clearest shape in the Report, whilst others, such as those relating to the practical applications of the science, which concern the investigation of the relations of weather to health and agriculture, are so expressed as to suggest the idea that the nature of the problems involved in these large national questions has not been apprehended by the Commission, and consequently no provision is made in the Report for their proper investigation.

But by far the most important recommendations are those which refer to the constitution and action of the Meteorological Council, or new governing body, who are to be entrusted with the control of the grant, and the relation of the Council to the meteorological societies, which call for the gravest consideration. The services of the Meteorological Committee of the Royal Society are not to be continued, as suggested by some of its members when under examination before the Commission, the reason assigned being that it is not to be expected that they will continue to give much valuable time to the work under the existing conditions. It is proposed that the Royal Society be invited to recommend to the Government persons eminent in science who shall constitute the Meteorological Council, that they be fewer in number than the present Committee, and that they be remunerated in the shape of fees for attendance. This proposed reform as regards the body to be entrusted with the control of the grant in future is thus more nominal than real, and it is not improbable, looking at the phraseology of this part of the Report, that the Meteorological Council will be substantially the same as those who form the present Meteorological Committee, the only difference being that they will be fewer in number.

The value of the work of the meteorological societies is acknowledged, and it is recommended that co-operation with them be fostered to the utmost. The amount, however, of the assistance which the Commission recommends to be given to these societies out of the Parliamentary Grant, is indicated in these words of the Report (Art. 23):—"No payments should be made to them, except for results sought for by the Council." In other words, no assistance, whatever, is to be given to the meteorological societies out of the grant, because, these payments being only for services rendered to the Meteorological Council, cannot be regarded as grants to the societies, and they will neither aid them in conducting their own operations, nor remunerate them for the services which have long been rendered, and continue to be rendered, to Government Departments.

It is not in this way that foreign countries foster the prosecution of meteorology by their different nationalities. Thus, Hungary has its separate grant distinct from that of Austria proper; Norway has its grant distinct from Sweden; many of the Germanic States have their separate grants; and, as the readers of NATURE are aware, France is divided into meteorological departments, all of which are subsidised by the State, and their operations are aided, but not controlled, by the central office in Paris. In all cases, this division of work and responsibility is productive of greater economy and efficiency in carrying on meteorological research. Voluntary local effort is in this way evoked in a degree and to an extent not otherwise possible, and the healthful principle of competition and mutual criticism, so desirable in the present state of the science, is called into active play. Surely some provision ought therefore to be made by our own Government, to subsidise these societies, it being on all hands admitted that voluntary subscriptions alone are inadequate for their permanent efficient maintenance. In no other way can they be placed in a position to discharge the duty of a public department in collecting statistics for the elucidation of the climatology of a country in its details and practical applications.

In the estimated expense of the Meteorological Office on its

proposed new footing, I observe that 1,500*l.* is set down annually for "New Land Stations," and in the appended outline of "Duties of Future Council," they are to place themselves in postal and therefore direct communication with about 150 secondary stations in the United Kingdom. What does this mean? Is it intended quietly but surely to supersede, and in a few years supplant the meteorological societies—a course which the Report not only permits to be done if the Council be so minded, but also includes in the grant an annual sum of 1,500*l.* which may be so applied?

It cannot be supposed that any council, composed of persons eminent in science, could be formed at present, possessing the knowledge and technical training required to direct the conduct of the whole field of meteorological research, both physical and climatological. Certainly, keeping in mind the serious mistakes made under the *régime* of the Meteorological Committee, and the manner in which the work of the office has been conducted, to both of which attention may here again be drawn, no other result can reasonably be expected than that the programme, as sketched in the Report of the Commission, is seriously in fault. The fact that the work was not efficiently controlled, was no doubt one of the main reasons of appointing the Commission; and, therefore, virtually to reappoint the same controlling body, only under another name, armed with the means and powers as proposed by the Commission, could scarcely fail to result in work of a more or less unsatisfactory nature, and, besides, in an unnecessarily increased expenditure of public money.

It is difficult to see how this result can be obviated, except by remitting the whole question of local climatology, including its practical applications, to bodies located in each of the three kingdoms, these societies being at the same time intrusted with supplying the Registrar-General, as has been done in the past, and such bodies as the Medical Council and the agricultural societies of the United Kingdom, with the information they may require. If 1,000*l.* were given for this work to each of the societies referred to, and 1,500*l.* to the Admiralty for the work of ocean meteorology, there would still be 10,000*l.* for the central office in London, to be devoted to the issue of storm warnings and to the prosecution of the more purely physical researches of meteorology, of which the science at present stands so much in need, and which is so emphatically the proper work of the central office: and in this case it need scarcely be added that each of the societies would necessarily be represented on the Meteorological Council. ZETA

Centralism in Spectroscopy

PERMIT me to repeat that happy remark of yours, and happy because so true and of wider application than the one meteorological case which called it forth, on p. 427; viz.: "We think centralisation hurtful to science, and we regret that 1,000*l.* a-year has not been granted to Scotland, by which a healthy rivalry would have been gained."

In the Anniversary Report of the Royal Astronomical Society for last month will be seen a statement that the Royal Observatory, Greenwich, amongst a vast deal of other most undoubtedly admirable work, is also now having a large spectroscope constructed on a totally new plan. How many spectroscopes that observatory has had made for itself during the last twenty years I do not know! and I, for one single individual in the nation, do not grudge this new one if it should realise only a third part of the wonderful promises made for it.

In the same Anniversary Report there is also a statement that the Royal Observatory, Edinburgh, has been in want of a proper spectroscope for its special local observations for years and years past; and if at length there is one there now, almost good enough for the required purposes, it is because such a one has been recently made at the private expense of the Astronomer-Royal for Scotland, although his salary is less than that of many a clerk in London.

Of this, also, I am told there is no reason to complain, because I accepted the situation in its poverty-stricken condition, though when the nation itself was also poverty-stricken as compared with its present truly heaven-favoured financial condition. But what I do, merely as an individual, complain of is—that if the new Greenwich spectroscope is to be the *only* one which the centralisation of the British Government in London allows to be built up at the expense of the whole nation, out of taxes levied in Ireland and Scotland as well as England, that it is being made on a principle which goes against the laws of Sir Isaac Newton and nature, and which, though it may give with "two

or at most three half-prisms" more dispersion than was before obtained by "ten whole ones," does so at the cost of *all definition*, and will be certainly allowed at Greenwich, as well as everywhere else, to be a mistaken step in modern spectroscopy before another anniversary of the Royal Astronomical Society takes place.

Edinburgh, March 17

Astronomer-Royal for Scotland

Greenwich as a Meteorological Observatory

IN NATURE (vol. xv. p. 421) there appeared a brief abstract of the presidential address of Mr. H. S. Eaton to the Meteorological Society of London on February 21. The increase of temperature at Greenwich in recent years is stated to be in reality due to local causes and not to secular variation, to which it has, as he thinks, been erroneously assigned. The effect of the growth of the population of London from 900,000 at the commencement of the century to 3,500,000 at the present time, and the still greater increase in the comparative consumption of coal, Mr. Eaton considers to be manifested by the rise in the average temperature of the air at the Royal Observatory, and for this reason it is concluded that Greenwich is not a suitable place for a meteorological observatory of the first order.

If the view enunciated by Mr. Eaton be correct, it is evident that the temperature of Greenwich during recent years has been in excess of that of surrounding districts. Is this view borne out by observation? Taking the figures for a number of places in the south-east of England whose mean temperatures have been calculated for the same thirteen years ending 1869, and adding the usual correction for height above the sea, we obtain the following results as their mean winter, mean summer, and mean annual temperatures; Greenwich, $40^{\circ}4$, $63^{\circ}1$, and $51^{\circ}1$; Camden Town, London, $40^{\circ}4$, $63^{\circ}3$, and $51^{\circ}1$; Royston, $40^{\circ}5$, $62^{\circ}3$, and $50^{\circ}8$; Colchester, $39^{\circ}4$, $62^{\circ}8$, and $50^{\circ}6$; Worthing, $41^{\circ}1$, $61^{\circ}2$, and $50^{\circ}7$; Osborne, $42^{\circ}0$, $62^{\circ}5$, and $51^{\circ}8$; Aldershot, $40^{\circ}9$, $62^{\circ}6$, and $51^{\circ}2$; and Oxford, $40^{\circ}6$, $61^{\circ}3$, and $50^{\circ}4$. A simple inspection of these figures is sufficient to show that the consumption of fuel and the vast population of London cannot be said to have had an appreciable influence on the temperature as recorded at the Royal Observatory, and that if the Greenwich observations show a rise of temperature during recent years, the whole of the south-east of England has shared in that rise. This result deduced from observations is such as might have been expected when the position of the thermometers at Greenwich and the mode of escape of the artificially heated air by chimneys into the free atmosphere is taken into consideration. It follows, therefore, that, so far at least as regards the temperature observations, the conclusion drawn as to the future of our great national Observatory as a contributor to the higher meteorological researches is not supported by the facts of observation.

ALEXANDER BUCHAN

Atmospheric Currents

I AM glad to have obtained from such exponents as Capt. Digby Murray and Mr. Murphy a clear statement of the old orthodox creed respecting the movements of the atmosphere.

The former, it is true, finds a difficulty in accepting Maury's belief that the currents cut one another in "curdles" in the equatorial calms, but none in adopting the same as regards the tropical calms, and his view may therefore, as I suppose, be taken as a modification of that which is graphically represented on Plate I. in the "Physical Geography of the Sea."

The question at issue between Capt. Digby Murray and myself amounts to this: Are rapid polar and equatorial upper currents observed over the region of tropical calms? Mr. Murphy's theoretical question appears to me to involve the inquiry—Is the force of the trades derived from the earth's rotation?

In tracing the course of the air particles along the route which he describes, the late Commodore Maury observes that this course is determined in certain particulars by "some reason which does not appear to have been very satisfactorily explained by philosophers." The latter do not as yet seem to have got rid of all the difficulties with which his theory is beset, which rather grow with its development.

I would beg the philosophers to look closely at the actual course of the atmospheric currents as shown by synoptic charts, not by charts of prevailing winds and mean pressures, which represent conditions never found at any one time in nature. The distinction between the "great currents" and the "temporary currents" is important enough, but it amounts to little more

than that between mean winds and actual winds; and to explain the mean winds on one principle and the actual winds on the opposite involves a fallacy.

Again and again we see a more or less irregular belt of high pressures, having central calms, extending across the North Atlantic. From the southern edge of this belt we may follow a particle of air in its course to and from the equatorial district of low pressure, also an irregular belt in the middle of which calms exist. The movement originates in the defect of pressure near the equator at the level occupied by the particle. Its velocity is governed by the steepness of the gradient; and its direction, in relation to the surfaces traversed, is affected by the increasing velocity of rotation of those surfaces. In the Doldrums it arrives at a district at which the gradient becomes zero and the horizontal movement has consequently disappeared; but a vertical movement has now been acquired from the difference in the tension of the particles above and beneath, a difference derived from solar heat. When the particle has arrived at a position in which this difference disappears the vertical movement vanishes, and a new horizontal movement commences owing to the defect of pressures on the polar side at the level then reached, and the direction of this movement is also affected in relation to the surfaces by their decreasing velocity of rotation. Where does the new movement terminate? Obviously in some district between the equator and the pole where horizontal pressures on all sides of the particle at its then level are equable, but where a vertical movement has been acquired, the particles near the earth's surface starting on their journey towards the equator. The *onus disputandi* lies with those who deny that such a district is presented by either of the belts of tropical calms.

We now look at the polar side of the calm belt of Cancer, and for this purpose we may take almost any, e.g., of Capt. Hoffmeyer's charts. We see in the majority of cases an aggregate of cyclonic circulations around local barometric minima, interfering and imperfect, and commonly becoming more so as they are propagated towards the pole. But we see no "polar depression" distinct from these, on which, as represented in the chart, we can lay the finger and say, "This is the result of centrifugal force; those are due to steam power." Within these systems an upward movement of the air occurs, owing to vapour condensation and the liberation of heat. Consequently towards these the particles of air near the earth's surface at the poleward edge of the tropical calms begin to travel, the earth's rotation deflecting their course in relation to the surfaces traversed. And from these, at a certain elevation, the particles return to the tropical calms for the same reason as that which determines the upper currents over the trades.

From the phenomena observed in the northern hemisphere I argue, *mutatis mutandis*, to those of the southern, and I expect the argument to be admitted by one who, like Mr. Murphy, attributes much less influence than I do to the work of water-vapour, and who even thinks that the mean movements of our atmosphere would be unaffected by the removal of all the water of our globe.

On some occasions pressure is high over all the North Atlantic on the polar side of the tropic, the anticyclones apparently extending nearly to the pole. In these cases we have no surface counter-trades over that district, yet the north-east trades continue to blow on the southward of the tropic as usual.

I repeat that all movements of the atmosphere originate in differences of pressure derived directly and indirectly from solar heat, and not in the force of the earth's rotation. And I must add that it seems to me very strange that any one while regarding the trades and their upper-currents as simply the effects of pressure differences in the lower latitudes, should maintain that the south-west and north-west winds of the temperate zones are simply the causes of the pressure differences in the higher latitudes. It would be just as logical to regard the south-west and north-west winds as due to pressure distribution, and the trades as the compensation for their eastward movement.

March 10

Electrical Phenomenon

LAST night I noticed a powerful development of electricity in a curious manner. I had thrown a piece of common, thick, white, unglazed paper upon a low fire which was tolerably full of ashes. When it was charred so as to be black and brittle, I happened to take it up and break bits off. To my astonishment they stuck firmly to my fingers. I broke off two pieces each an inch long, and resting them on the tips of my two fore-fingers,